

# Update on Xsuite modelling of BT

**John Salvesen, Nikita van Gils**

# BTe BTp lattices in Xsuite

Lattices were converted to Xsuite using the SAD2XS converter (J. Salvesen)

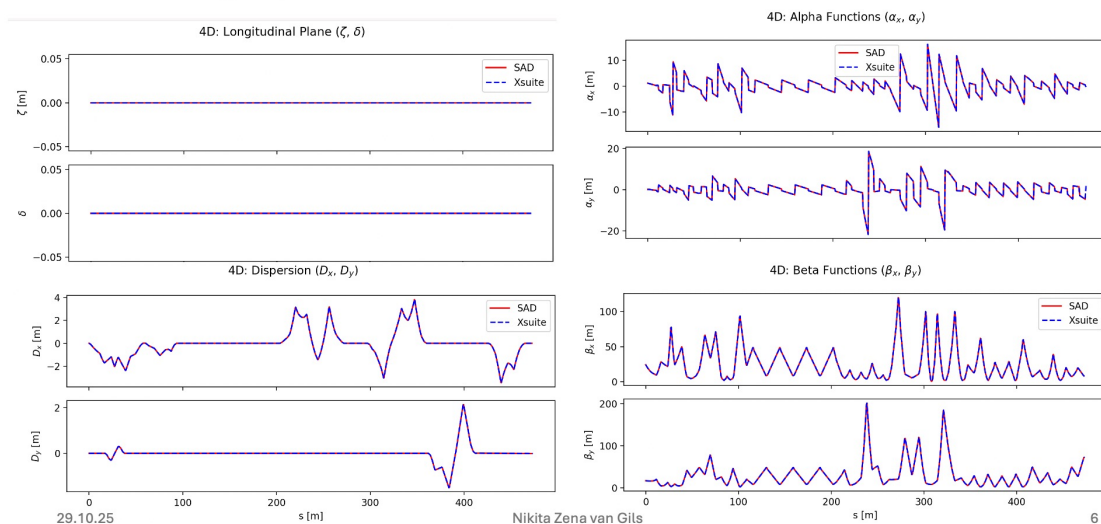
- Converter publicly available on Github ( <https://github.com/jpts2/sad2xs> )
- Also available on PyPI

## BTe Xsuite Status

Benchmarks in **4D** show excellent agreement

NB: Further comparisons in backup slides

- No rematching required

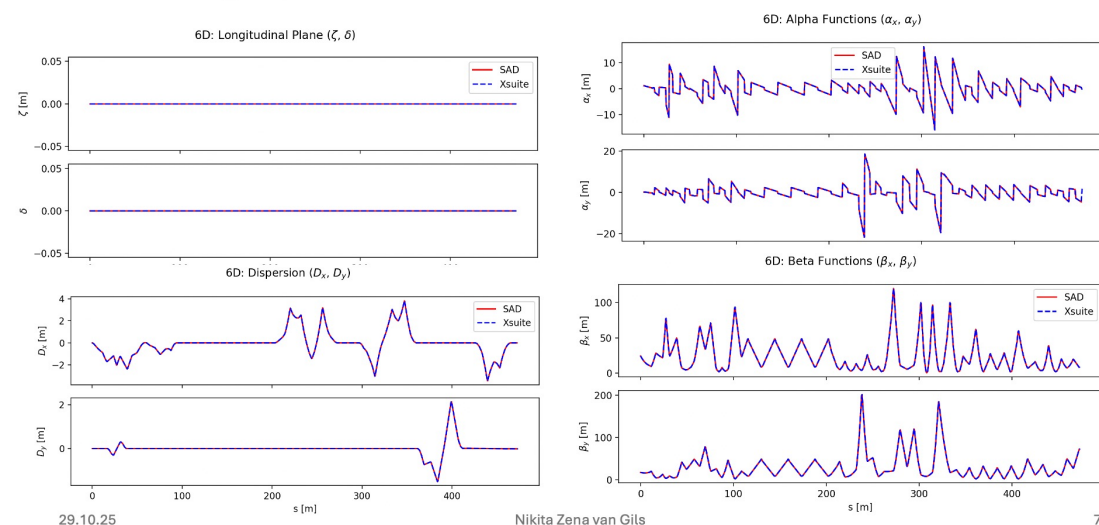


## BTe Xsuite Status

Benchmarks in **6D** show excellent agreement

NB: Further comparisons in backup slides

- No rematching required



# Where are we at with BTe?

**BTe (with new ECS) in Xsuite has been compared to SAD (files received from Morisani) in 4D and 6D with excellent agreement between the two (4D,6DTwiss &Track)**

**We obtained a tracked beam from LINAC to the entrance of BTe by Andrea A. (thank you!) with wakefields.**

**We then used this as input distribution into BTe**

**As a first step: the beam was then tracked to end of line and compared to MA/DA of HER to estimate injection efficiency.**

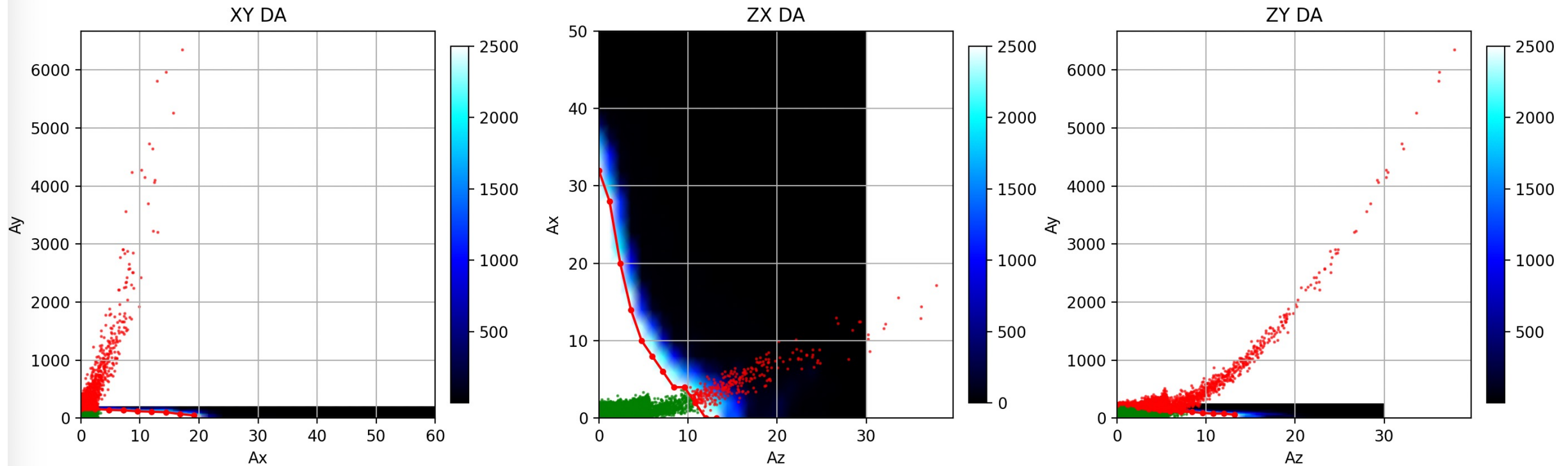
**NEXT STEP: take septum magnet into account in terms of acceptance into ring (injection efficiency). May need to do coordinate transformation to compare**

# Some sanity checks

**Does the ECS off cause any change in delta?**

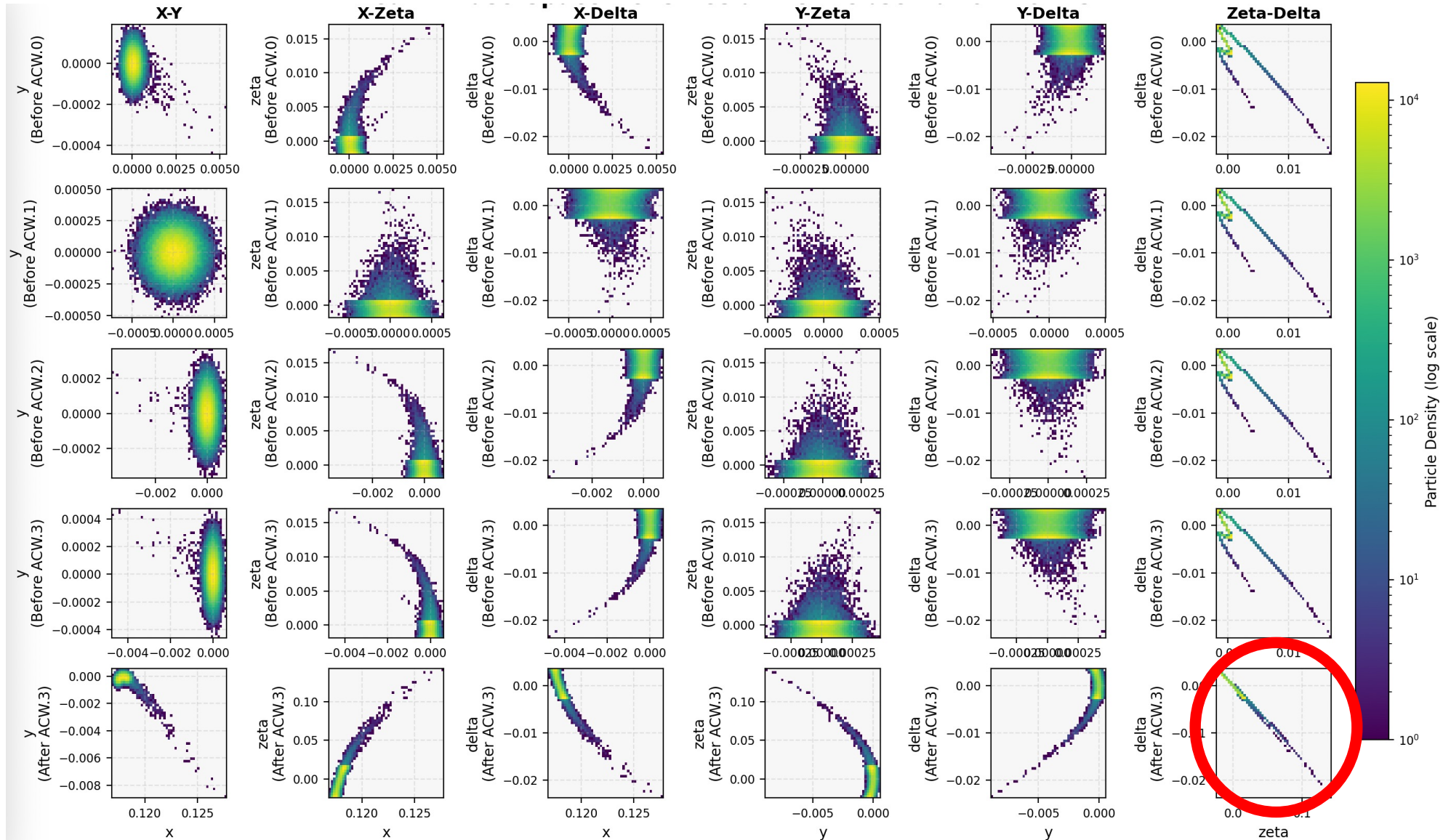
# ECS Voltage=0, magnets unchanged

DA Overlays at Optimal Lag = 180.00 | Total Survival = 0.8107

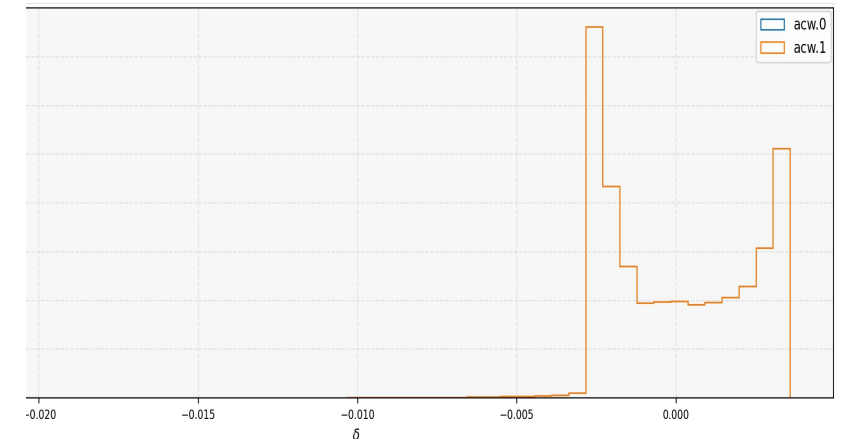
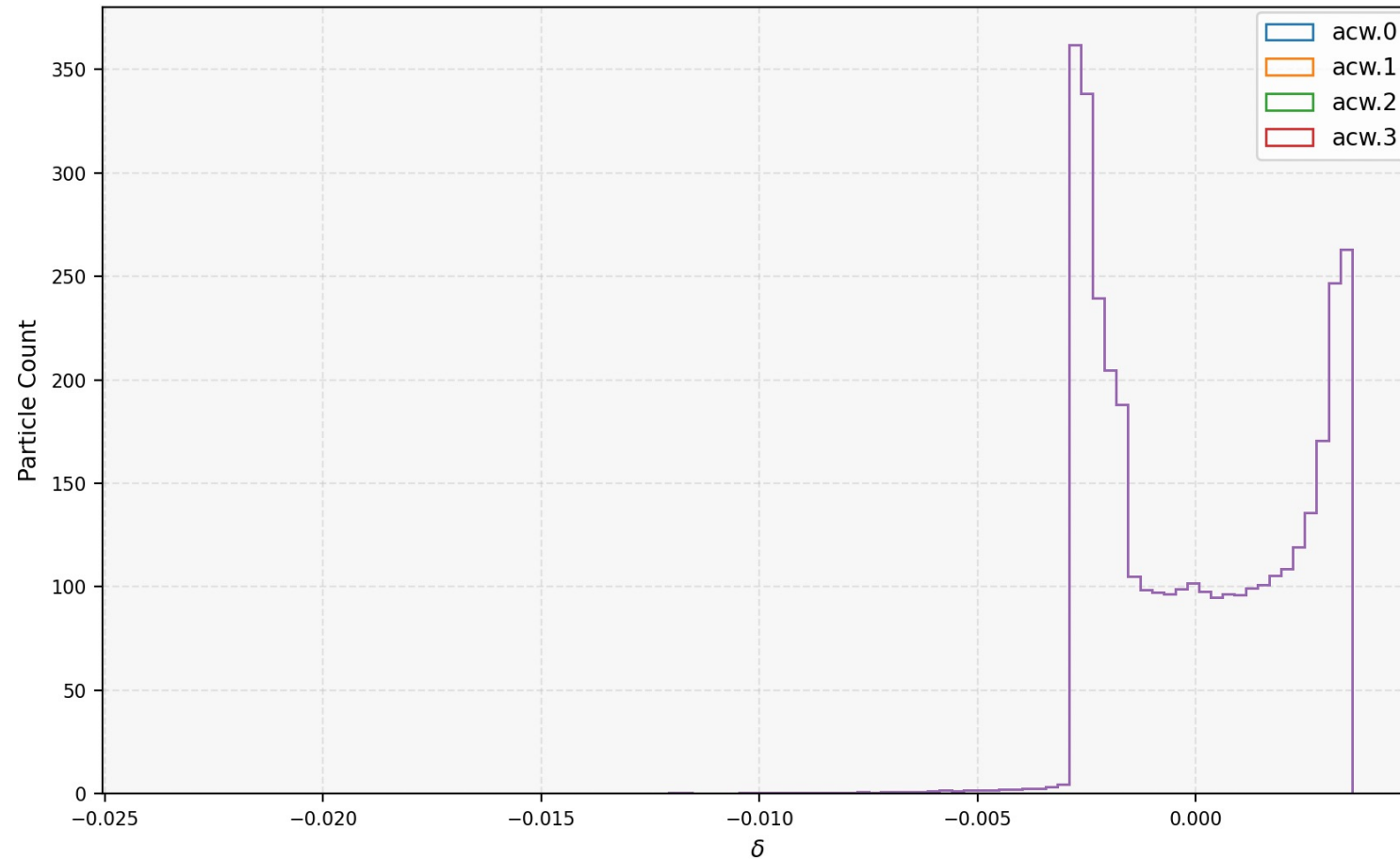


Reach ~81% acceptance into ring with ECS off

# ECS Voltage=0, magnets unchanged



# ECS off quads nominal



Delta remains unchanged along ECS. Difference is likely due to magnetic elements (nominal values)

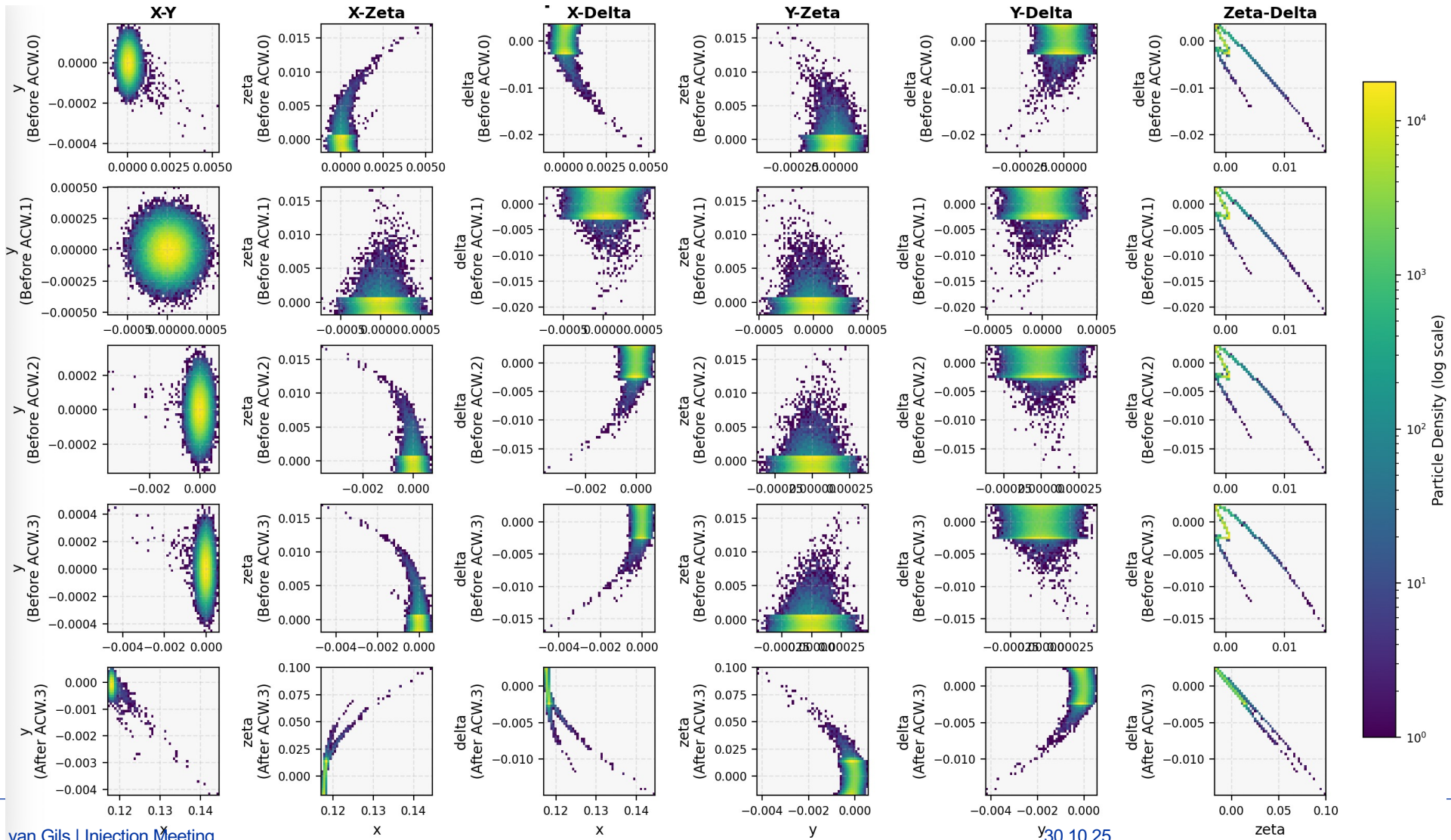
Purple: after acw.3

# Some sanity checks

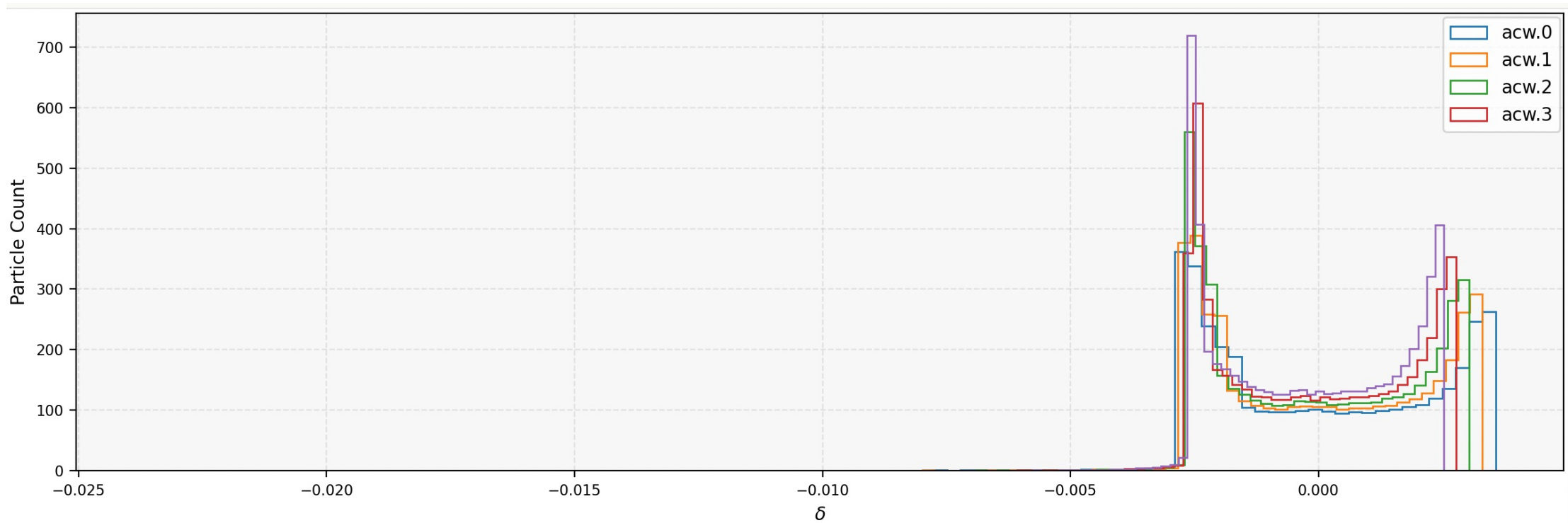
Does the ECS Voltage=0 cause any changes in delta? *Delta remains unchanged along ECS. Difference is likely in  $y$  due to magnetic elements (nominal values)*

If we take the zero crossing (180 in Xsuite) does the bunch get shorter?

# With the ECS on 18MV, zero crossing



# With the ECS on 18MV, zero crossing



Indeed the bunch is being compressed along the ECS

Purple: after acw.3

# Some sanity checks

Does the ECS Voltage=0 cause any changes in delta? *Delta remains unchanged along ECS. Difference is likely in  $y$  due to magnetic elements (nominal values)*

If we take the zero crossing (180 in Xsuite) does the bunch get shorter? *Yes, but tails also appear more populated.*

# Tracking the beam to injection point and comparing to the HER MA/DA

HER MA/DA provided by Jack S. (Xsuite modelling of HER/LER)

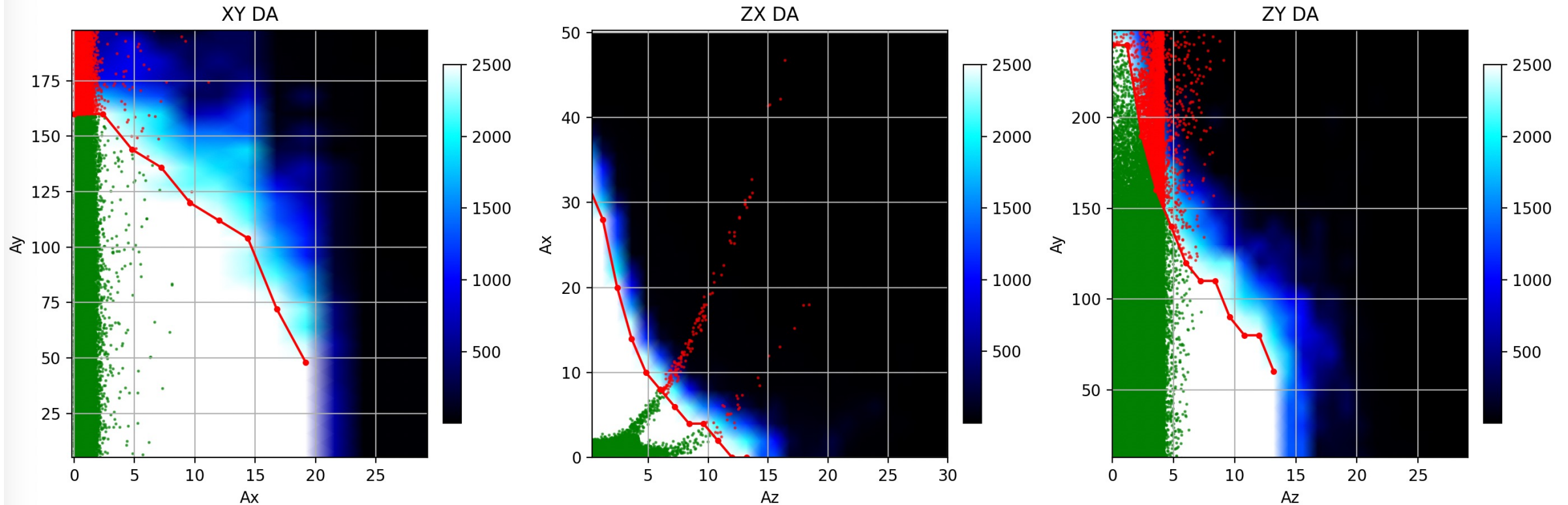
Very first estimate of injection efficiency (does not yet include septum - work in progress)

May need to be adjusted due to coordinate shifts... **very** preliminary

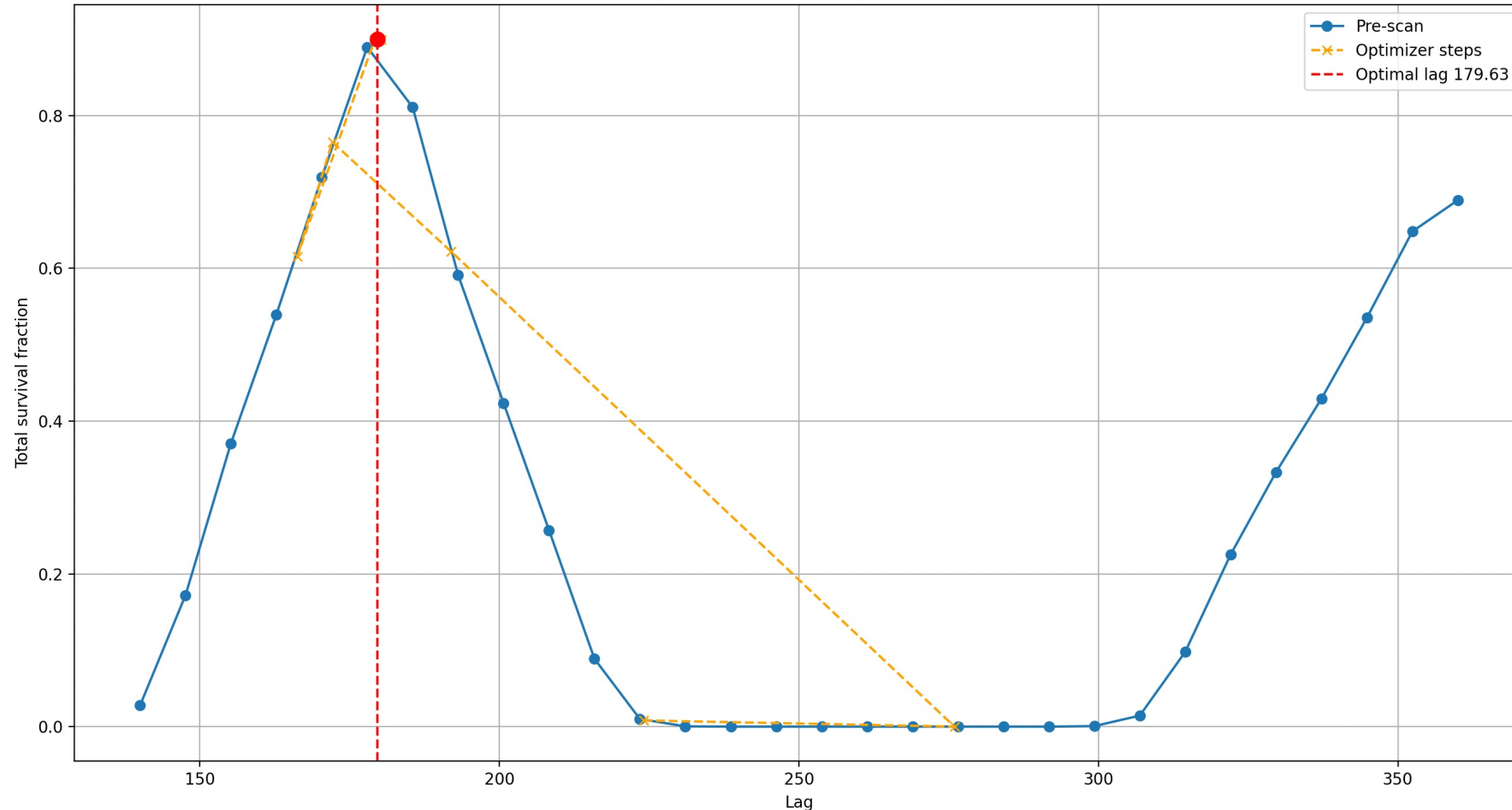
# Tracking the beam and comparing to the HER MA/DA

**WORK IN PROGRESS**

**DA Overlays at Optimal Lag = 180.00 | Total Survival = 0.8999**



# Optimisation: changes all four lags (at the same time) and checks survivability within DA/MA



Optimal at zero crossing (180) → another sanity check → we are happy

# Next steps:

***Implement septum in cut in order to make more clear comparison between injection beam and ring acceptance.***

***Do a 2D optimisation of ECS lag and voltage → what are the limits on the voltage?***

***Adjust for orbit due to different delta?***

# Comments/questions

## ***Septum implementation: coordinate transformation required?***

There is a COORD\_transformation in BTe (assumed to give coord transf. from BT to main ring?) but not BTp. Will have to check if this is sufficient to place septum in line. INJP=INECTIO? But have no common point (or transformation) in BTp.

## ***2D optimisation of ECS sufficient (voltage+lag) or additional parameter to be added? Require delta = 0 after ECS?***

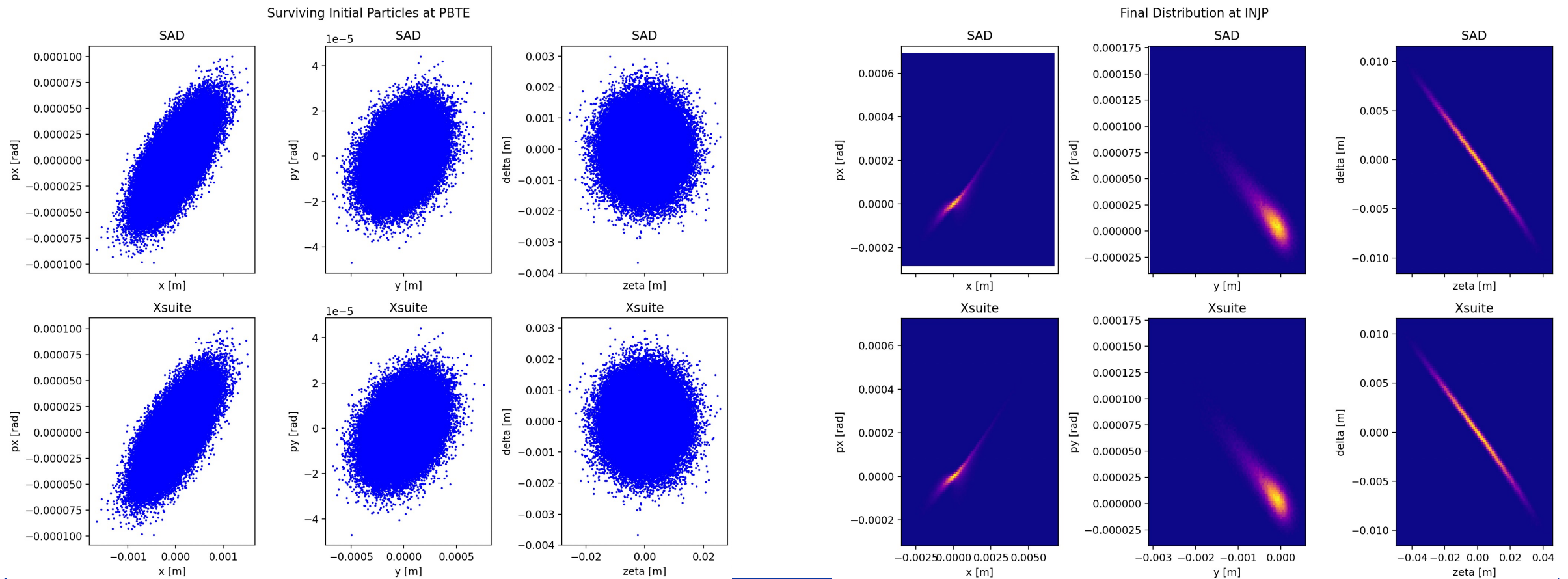
***In operation ~100MV Voltage was used in ECS,***

***Bonus point: Optimisation with different lags for every cavity? (could help see if increasing number of powersupplies could be a good option)***

# Backup slides

# BTe tracked lattices in Xsuite vs SAD

Comparison SAD/XSuite with Gaussian input beam into BTe



# Off zero crossing lag 185 causes orbit of reference particle

